C4I Embedded Simulation Infrastructure Prograr

C4I Mission Application Software Development Kit (MASDK)

Practical Composability!

Navy Modeling & Simulation Management Office
Technical Interchange Meeting (TIM)
August 19, 2004

Naval Research Laboratory

Current Limitations in C4I

For Simulation-Based Mission Applications

C4I Systems:

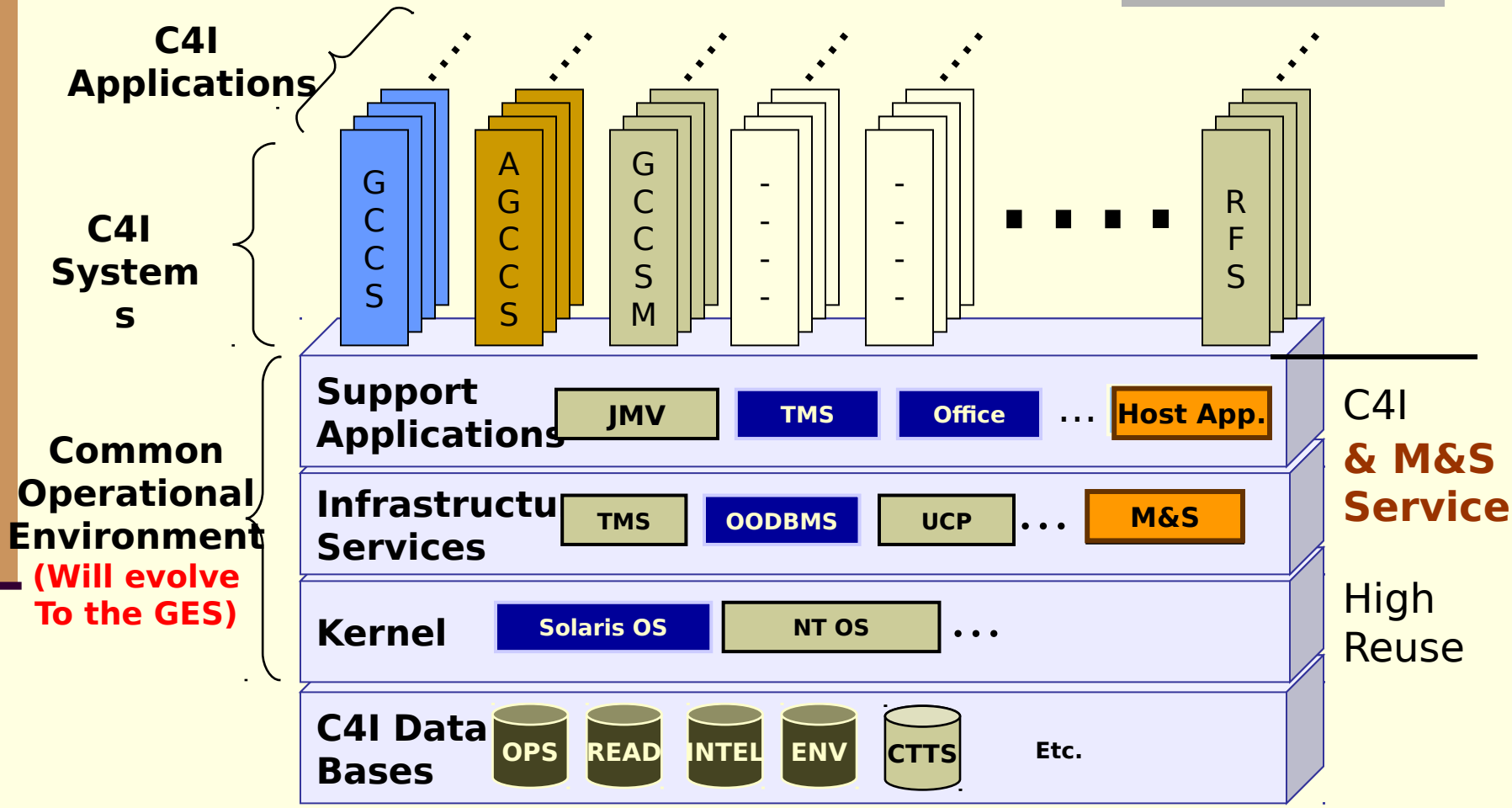
- Operate in current time with real world data.
- Present a single common operational picture.
- Communicate as global broadcast systems.

Simulation Based Applications (e.g., Planning, Course of Action Analysis) require:

- Variable time bases.
- Analysis of “What if?” situations.
- Local perceptions.
- Peer-to-peer collaboration.

COE Compliant C4I Systems

Development and Runtime Environment



Solution: Provide M&S extensions for simulation based applications

C4I Mission Application SDK
Solution

- Development **Process** that manages complexity.
- Sharable C4I M&S **Services**.

C4I Mission Application SDK

Development **Process** Features

- ***In-Situ Development*** – Mission Applications, prototype models and simulations are developed within the C4I environment in which they will operate.
- ***Host Applications*** – A Mission Application shell which contains basic services and serves as a host to, models, simulations and selected reusable elements.
- ***Composability Tools*** – Allows a developer to rapidly configure, develop and employ a C4I Mission Application by assembling it from a collection of reusable elements.

M&S Services Requirements

What does the MASDK provide?

MASDK provides services that:

- Link simulations to COE & C4I applications.
- Manage simulated data.
- Manage variable time bases.
- Perform format, data, protocol conversions.
- Generate scenarios.
- Provide distributed Application capabilities.

Mission Application SDK
Current Sharable Software Components

M&S Services

- Archive
- ATO Parser
- Client Plug-in
- Common Operational Picture (COP) Capture
- Data Base Client
- Debrief Editor
- DIS Server
- Event Manager
- Exercise Track Management System (XTMS)
- HLA/RTI Ambassador
- LATR Interface Mission Editor
- Plan Preview
- Replay
- Run Time (Time base Management)
- Server Plug-in
- Time Line Display / Editor
- Training TUTOR
- Virtual Track Manager

Compliant Simulations

- Hazard Prediction Assessment Capability (HPAC)
- Cruise Missile Trainer (CMT)

Models

- Visibility Manager
- Mobile Sensor Model
- Visual LOS Model
- UAV Plug-in

Development Tools

- C4I Simulator/Stimulator
- Training AUTHOR
- Host Applications
- Composability Tool

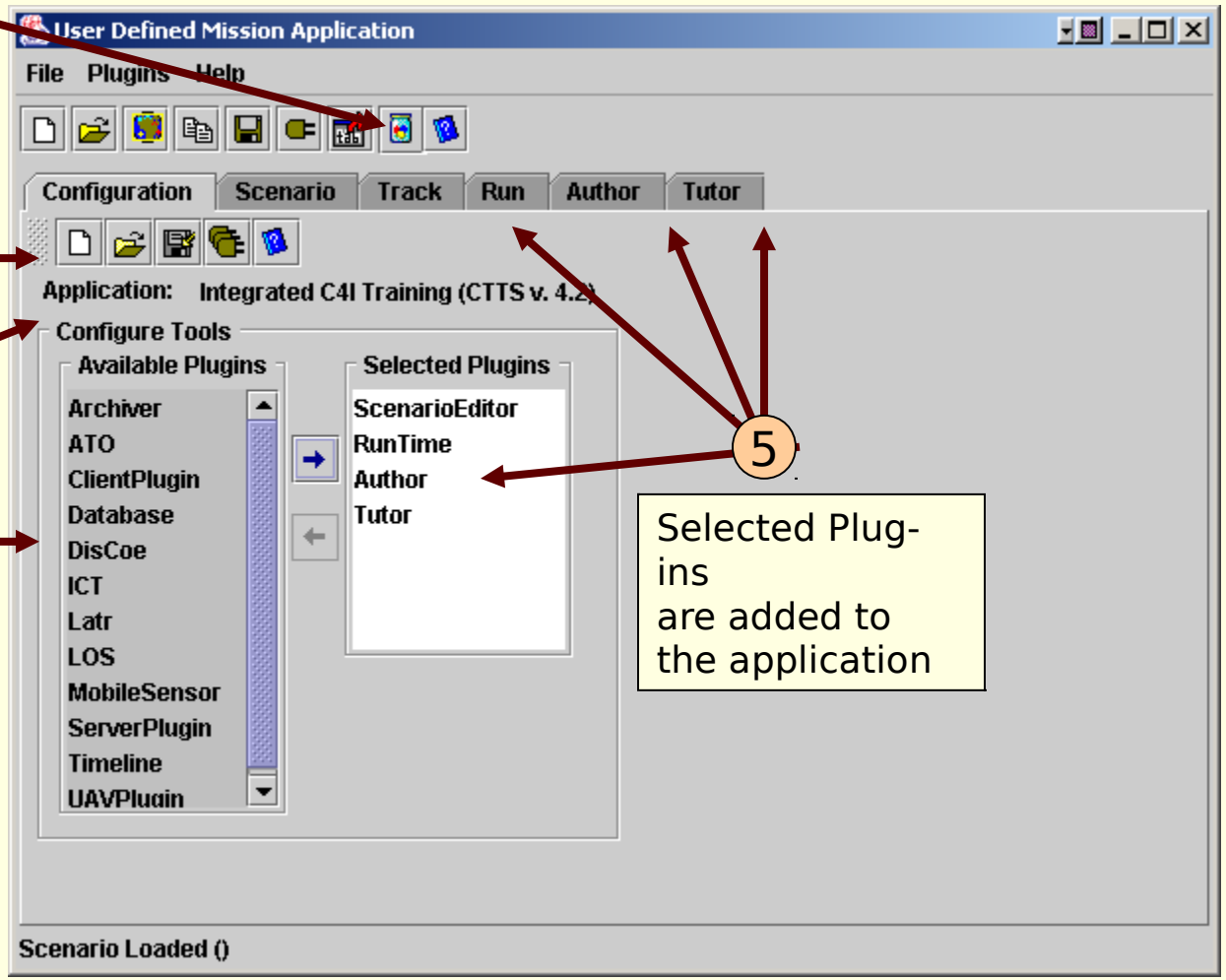
MASDK Host Application
Composability Tool

Select or hide the Composability Tool (Configuration tab)

Select Application (or New)

Application name appears

Choose the Plug-in and click the right arrow

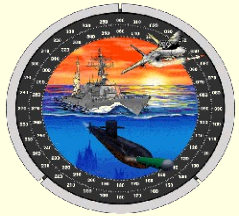


Selected Plug-ins are added to the application

Example Applications

Containing MASDK services

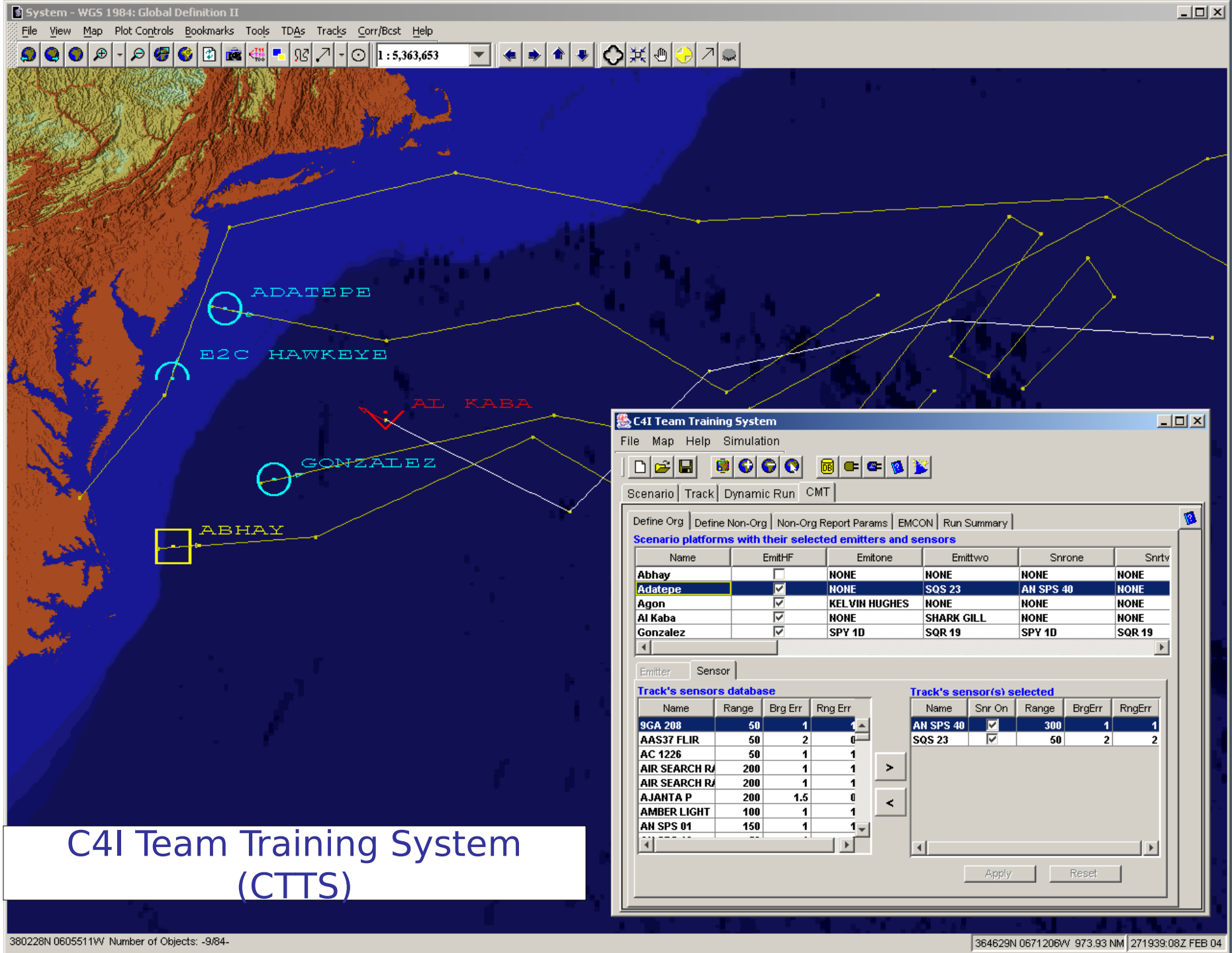
1. C4I Team Training (CTTS)
2. GCCS/M Training Author & Tutor
3. Weapons of Mass Destruction Defense
4. Range Fusion System
5. Transit Training
6. Predator Down Link Trainer
7. ATO Plan Analysis
8. HLA/RTI (C4I Federates for 7 HLA Federations)
9. Mission Editor 4.2
10. Multi-Ship Synchronization
11. Archive, Reconstruction, Debrief



Composability* Example: C4I Team Training System (CTTS)

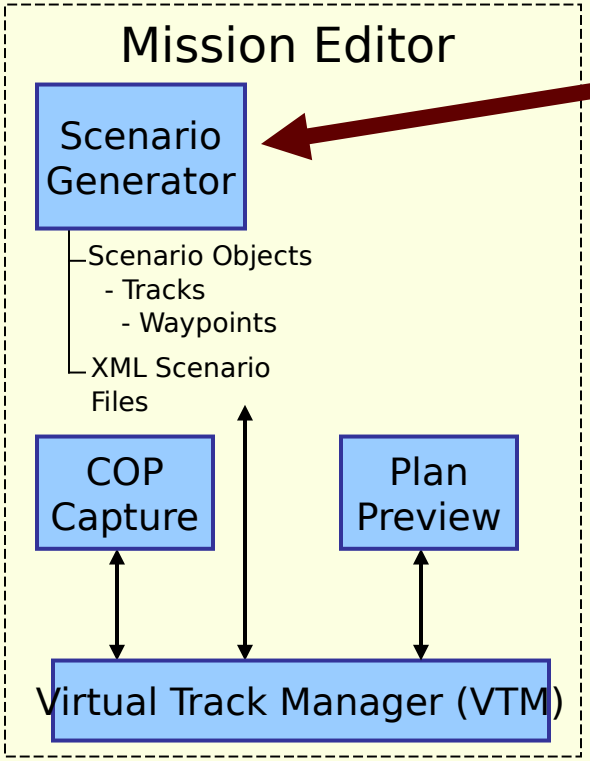
click to play video

- Global Command and Control System Maritime (GCCS-M) Application
- Fully embedded
- Contains the Cruise Missile Training (CMT) Simulation

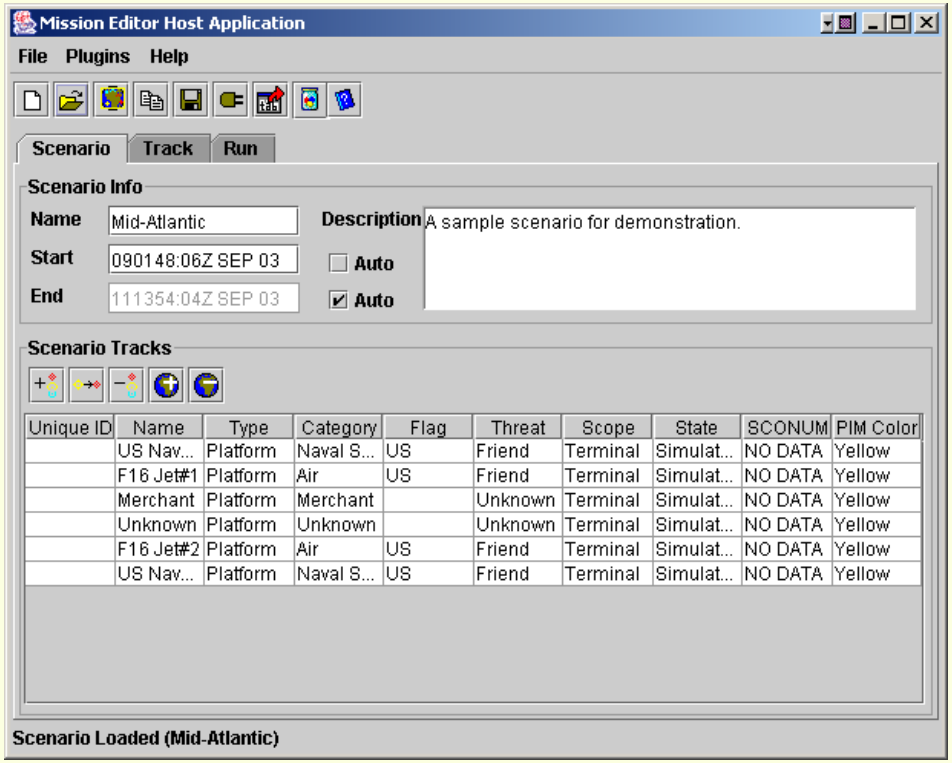

System - WGS 1984: Global Definition II
File View Map Plot Controls Bookmarks Tools TDAs Tracks Corr/Bcst Help
1 : 5,363,653
ADATEPE
E2C HAWKEYE
AL KABA
GONZALEZ
ABHAY
C4I Team Training System
File Map Help Simulation
Scenario Track Dynamic Run CMT
Define Org Define Non-Org Non-Org Report Params EMCON Run Summary
Scenario platforms with their selected emitters and sensors
Name EmitHF Emitone Emittwo Snrone Snrtv
Abhay NONE NONE NONE NONE
Adatepe NONE SQS 23 AN SPS 40 NONE
Agon KELVIN HUGHES NONE NONE NONE
Al Kaba NONE SHARK GILL NONE NONE
Gonzalez SPY 1D SQR 19 SPY 1D SQR 19
Emitter Sensor
Track's sensors database
Name Range Brg Err Rng Err
9GA 208 50 1 1
AAS37 FLIR 50 2 0
AC 1226 50 1 1
AIR SEARCH RA 200 1 1
AIR SEARCH RA 200 1 1
AJANTA P 200 1.5 0
AMBER LIGHT 100 1 1
AN SPS 01 150 1 1
Track's sensor(s) selected
Name Snr On Range BrgErr RngErr
AN SPS 40 300 1 1
SQS 23 50 2 2
Apply Reset
C4I Team Training System (CTTS)
380228N 0605511W Number of Objects: -9/84-
364629N 0671206W 973.93 NM 271939:08Z FEB 04

Composability Example: CTTS

Add the Scenario Generator



The **Scenario Generator** is a common component used in a wide range of C4I planning, training & analytical applications.

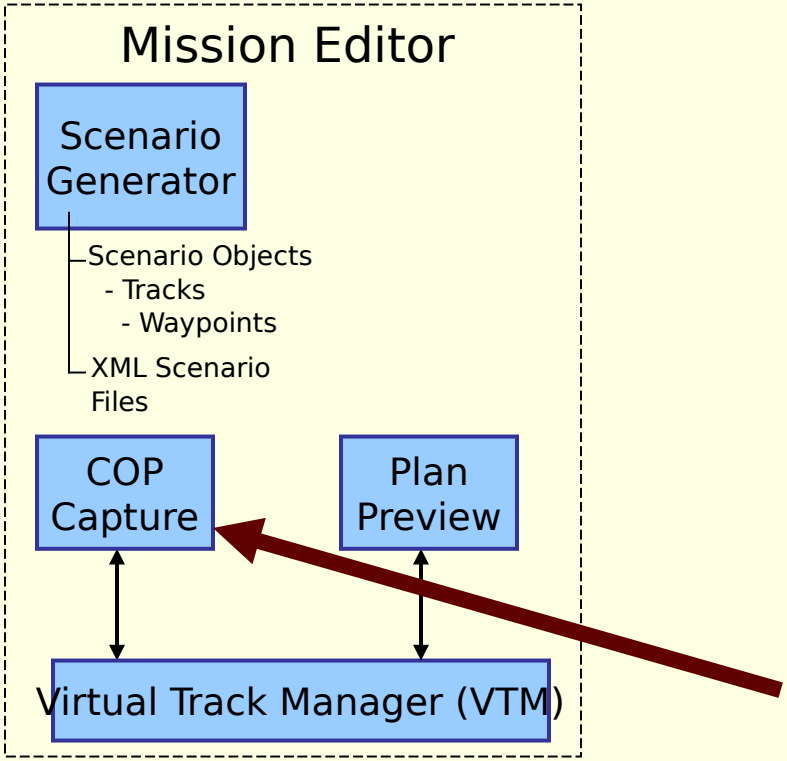

Mission Editor Host Application
File Plugins Help
Scenario Track Run
Scenario Info
Name Mid-Atlantic
Description A sample scenario for demonstration.
Start 090148:06Z SEP 03
Auto
End 111354:04Z SEP 03
Auto
Scenario Tracks
Unique ID | Name | Type | Category | Flag | Threat | Scope | State | SCONUM | PIM Color
US Nav... | Platform | Naval S... | US | Friend | Terminal | Simulat... | NO DATA | Yellow
F16 Jet#1 | Platform | Air | US | Friend | Terminal | Simulat... | NO DATA | Yellow
Merchant | Platform | Merchant | | Unknown | Terminal | Simulat... | NO DATA | Yellow
Unknown | Platform | Unknown | | Unknown | Terminal | Simulat... | NO DATA | Yellow
F16 Jet#2 | Platform | Air | US | Friend | Terminal | Simulat... | NO DATA | Yellow
US Nav... | Platform | Naval S... | US | Friend | Terminal | Simulat... | NO DATA | Yellow
Scenario Loaded (Mid-Atlantic)

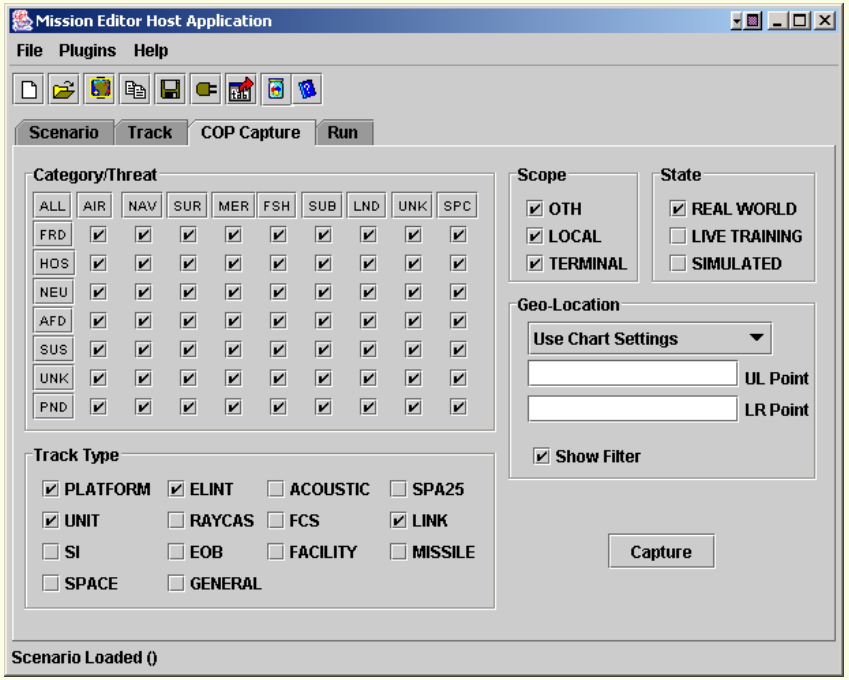
Create the Mission

- MA SDK Component

Composability Example: CTTS

Start with the Mission Editor (COP Capture)





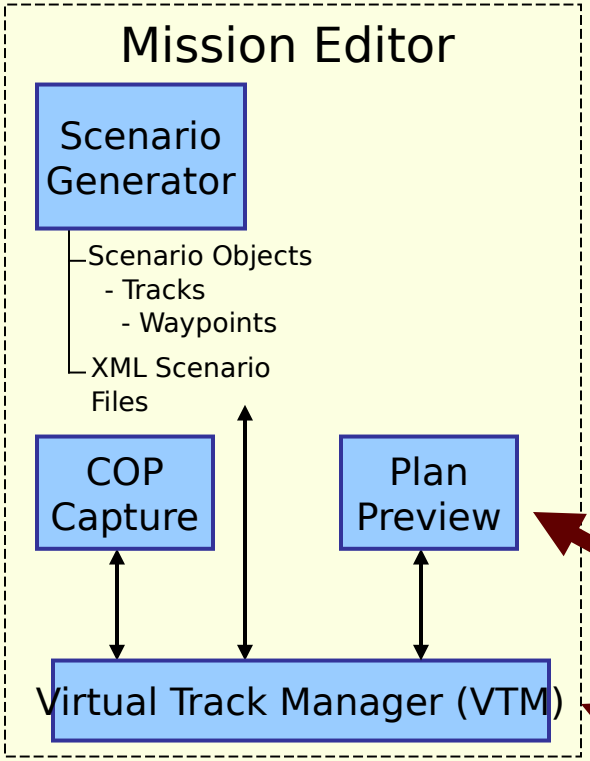
COP Capture provides current real world data for simulation initialization and time projection analysis.

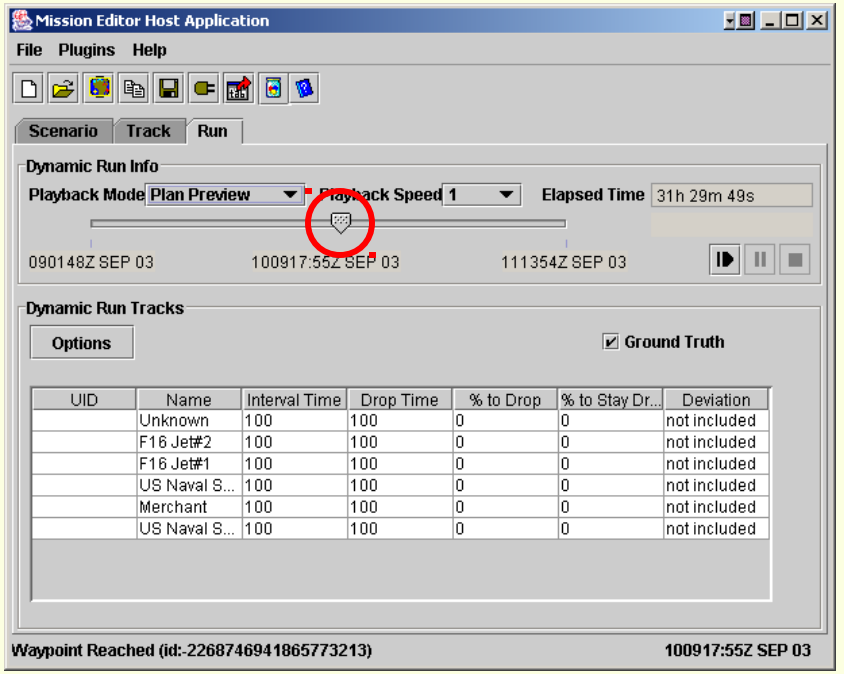
Create the Mission

- MA SDK Component

Composability Example: CTTS

Add the Plan Preview & VTM to the Mission Editor




Mission Editor Host Application
File Plugins Help
Scenario Track Run
Dynamic Run Info
Playback Mode Plan Preview
Playback Speed 1
Elapsed Time 31h 29m 49s
090148Z SEP 03
100917:55Z SEP 03
111354Z SEP 03
Dynamic Run Tracks
Options
Ground Truth
UID Name Interval Time Drop Time % to Drop % to Stay Dr... Deviation
Unknown 100 100 0 0 not included
F16 Jet#2 100 100 0 0 not included
F16 Jet#1 100 100 0 0 not included
US Naval S... 100 100 0 0 not included
Merchant 100 100 0 0 not included
US Naval S... 100 100 0 0 not included
Waypoint Reached (id:-2268746941865773213)
100917:55Z SEP 03

Run Plug-in allows the user to play and preview the scenario.

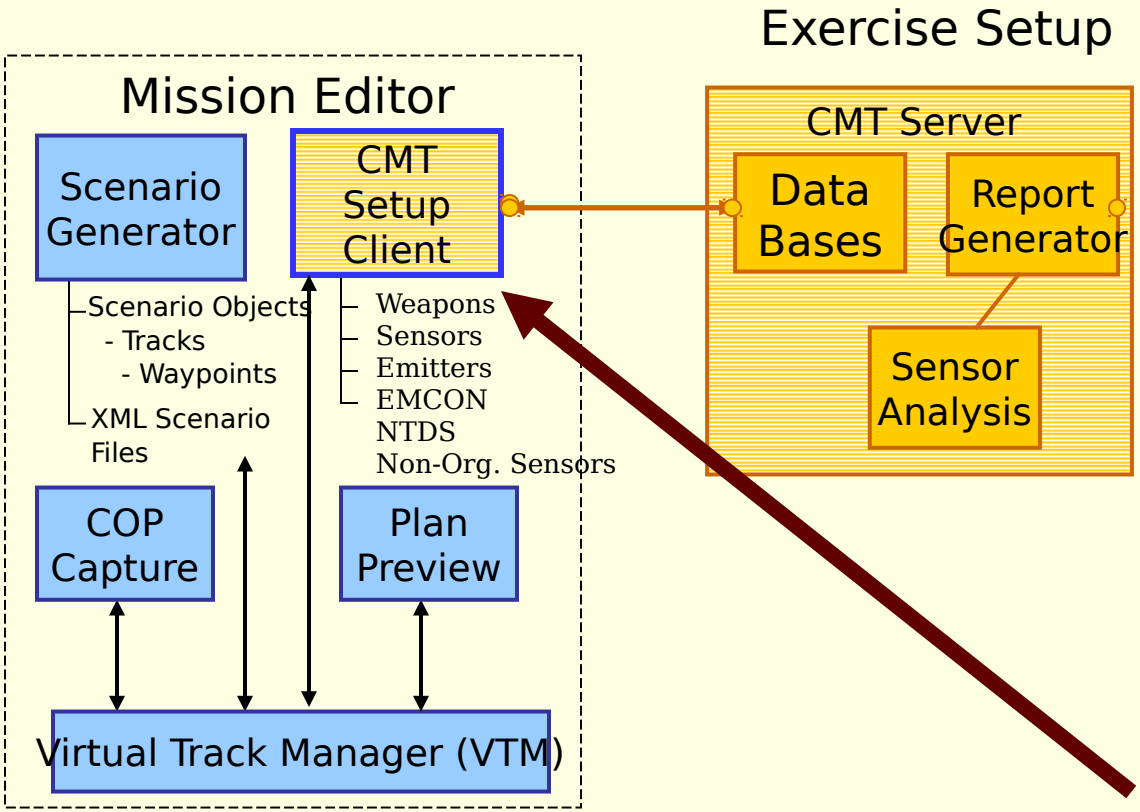
The **Virtual Track Manager** is used to store and manipulate scenarios.

Create the Mission

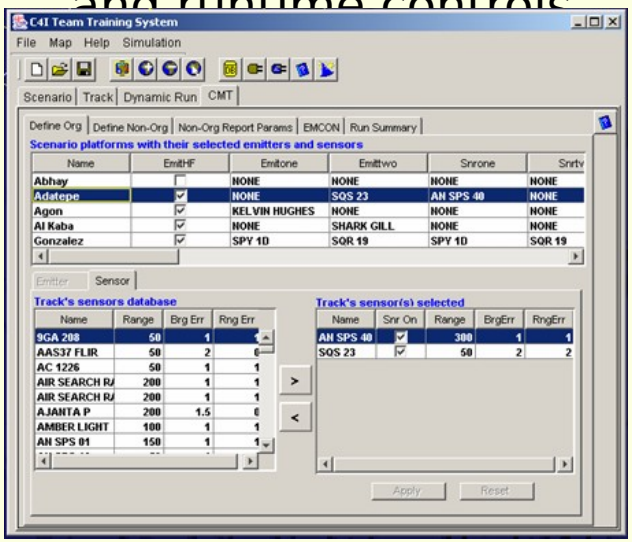
- MA SDK Component

Composability Example: CTTS

Develop the Simulation **Setup** Interface



The **CMT Client Plug-in** is tailored to the specific embedded simulation **(i.e, Cruise Missile Trainer)** to provide parametric inputs, user interface and runtime controls

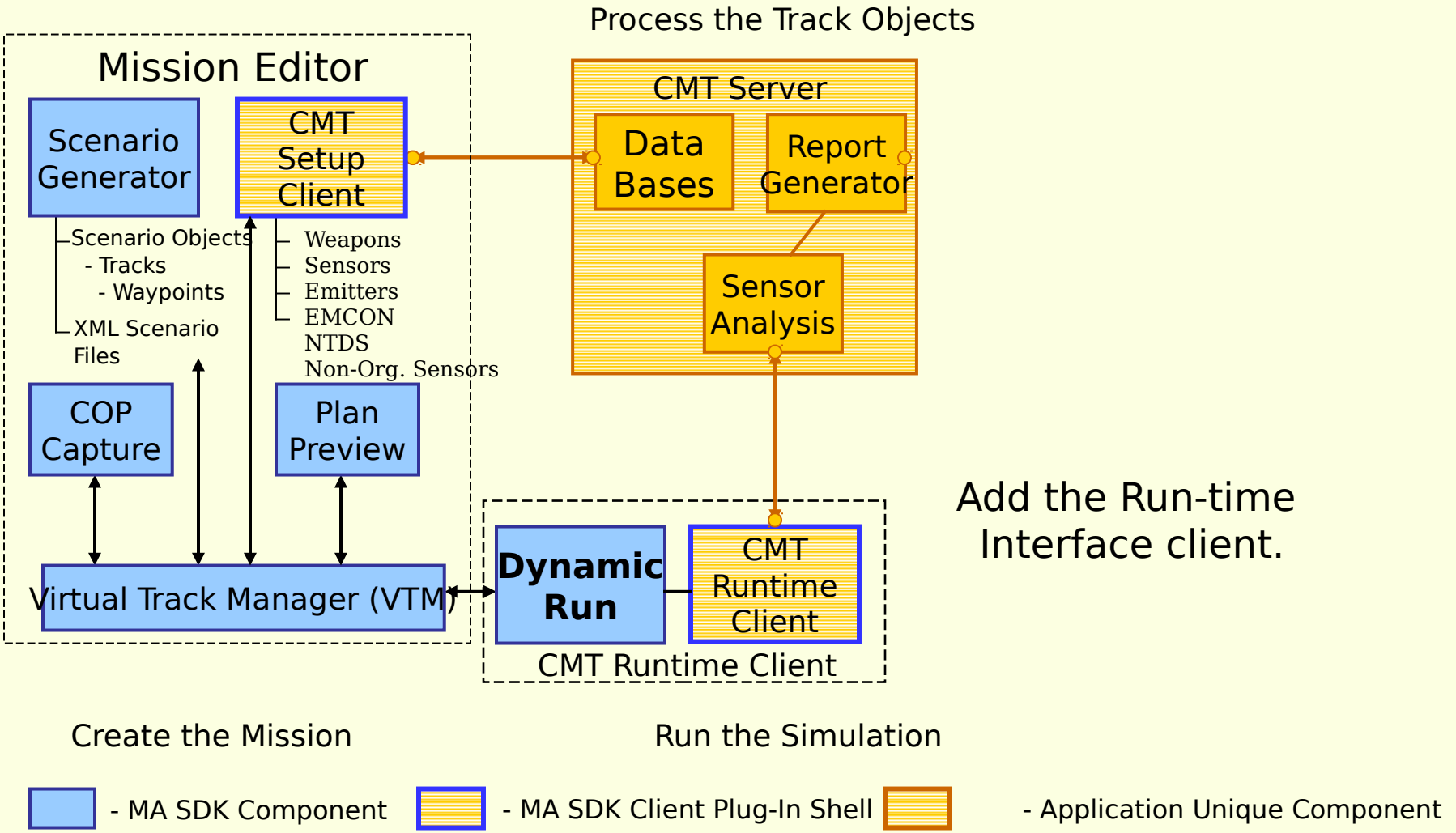

C4I Team Training System
File Map Help Simulation
Scenario Track Dynamic Run CMT
Define Org Define Non-Org Non-Org Report Params EMCON Run Summary
Scenario platforms with their selected emitters and sensors
Emitter Sensor
Track's sensors database
Track's sensor(s) selected
Apply Reset

Create the Mission

- MA SDK Component
- MA SDK Client Plug-In Shell
- Application Unique Component

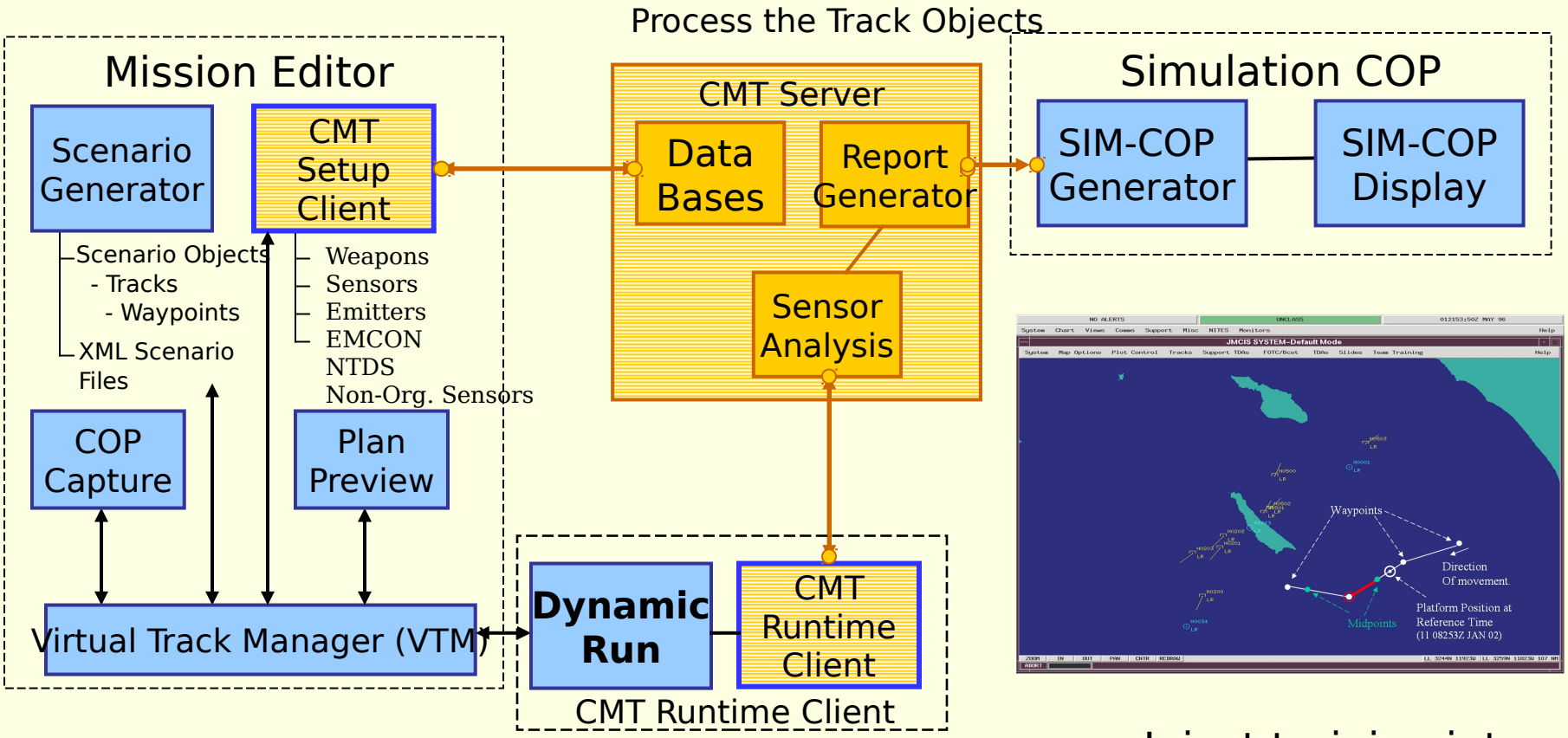
Composability Example: CTTS

Develop the Simulation **Runtime** Interface



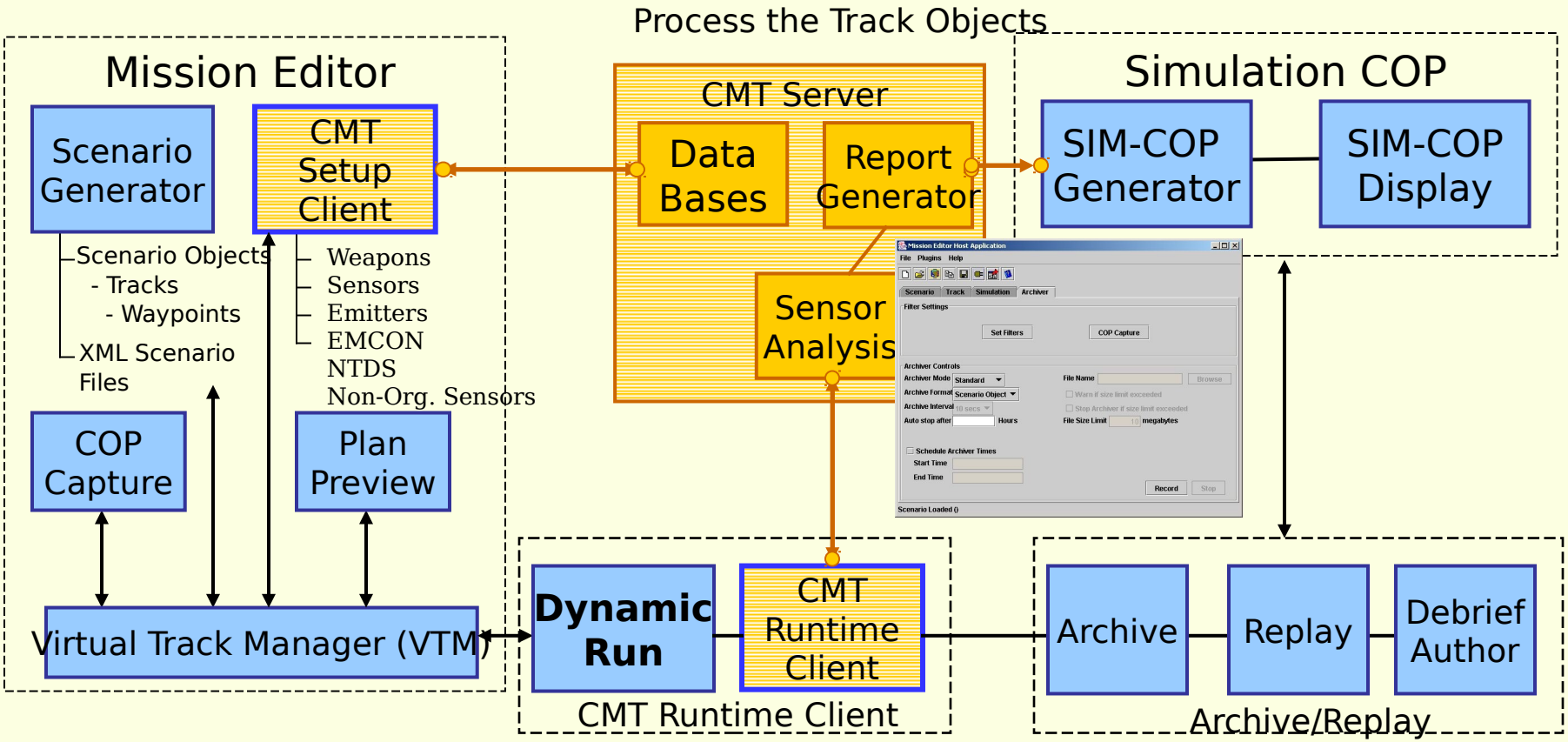
Composability Example: CTTS

Develop the Simulation **Output** Interface



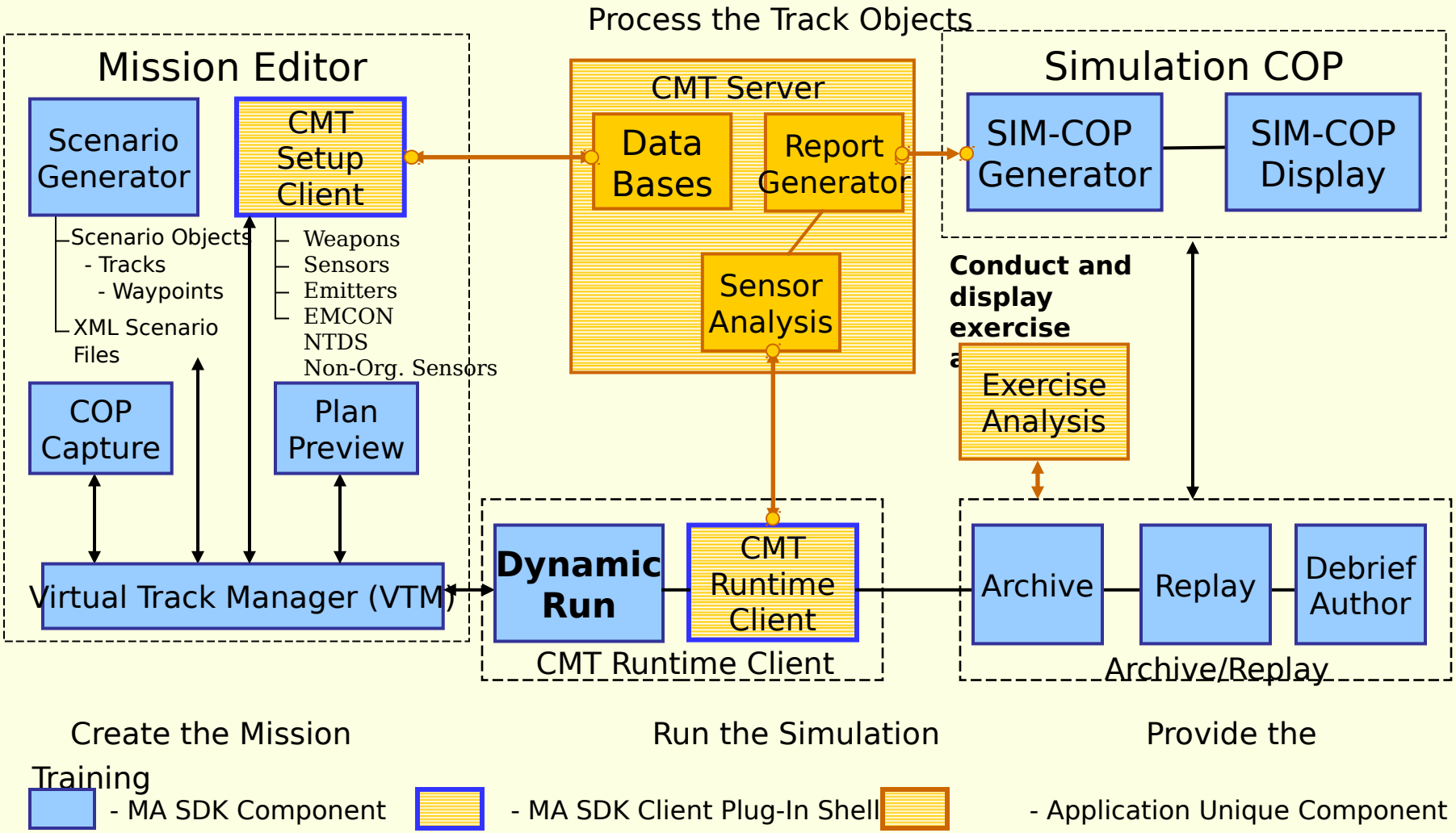
Composability Example: CTTS

Add Archive, Replay & Debrief **Plug-ins**



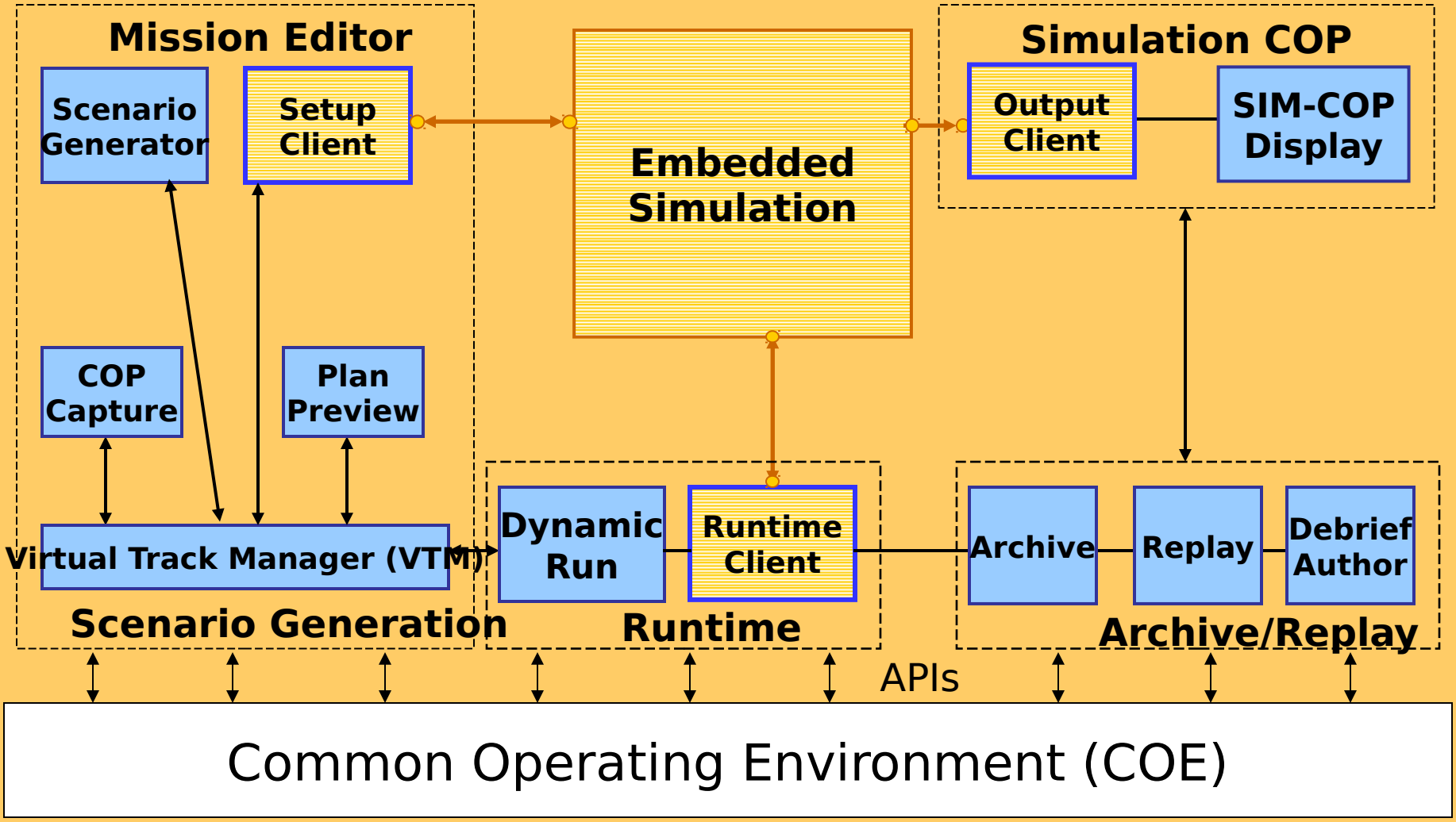
Composability Example: CTTS

Develop any **Unique** Functions



C4I M&S Host Application

Generic Architecture for Scenario Based Applications



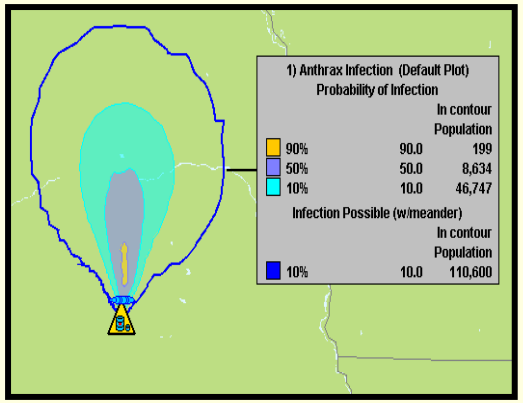
Other Applications

- Weapons of Mass Destruction Defense
- Predator Down Link Trainer

Weapons of Mass Destruction Defense

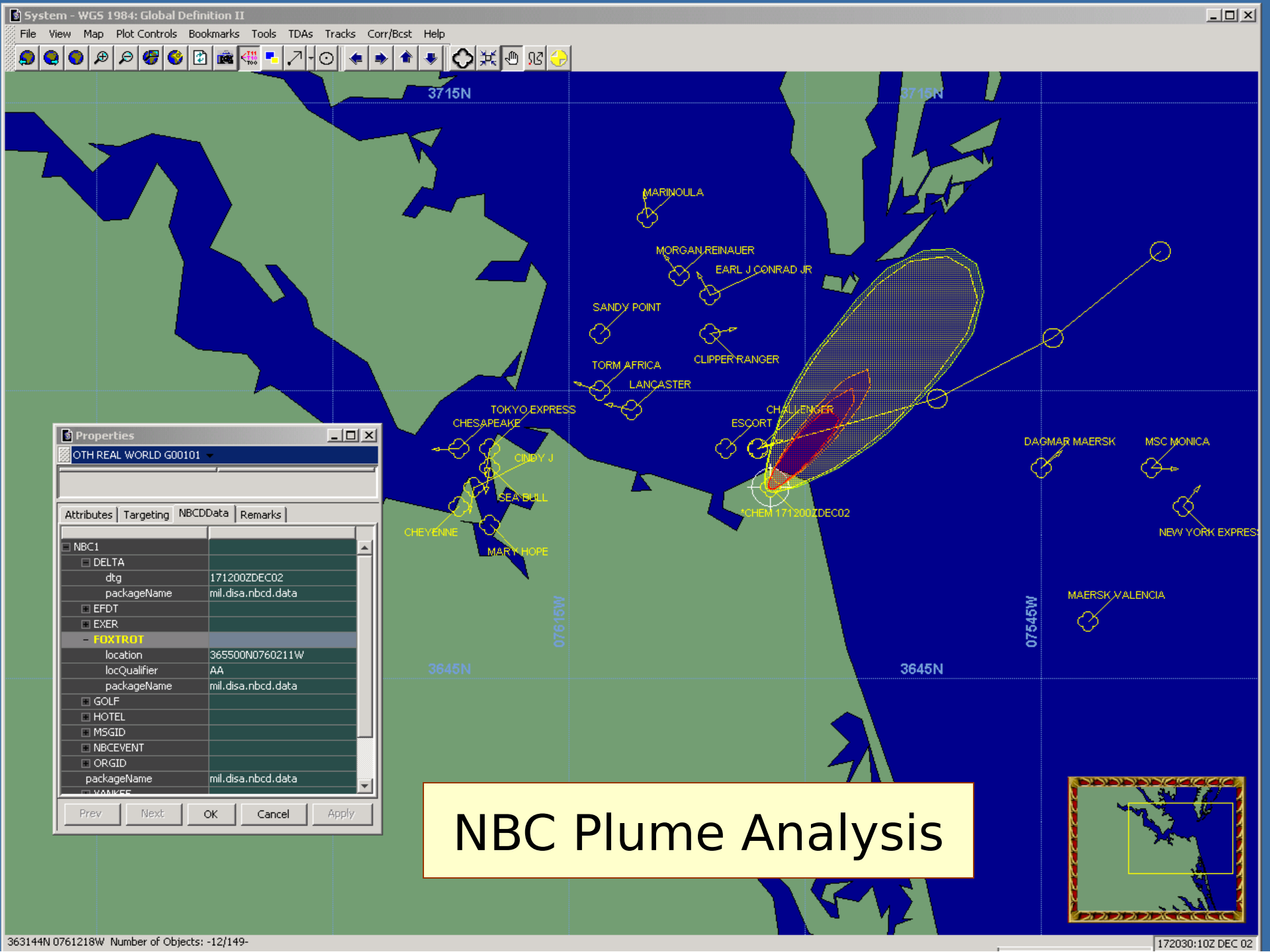
Requirements

Provide C4I an on-site situational awareness of nuclear, biological, and chemical (NBC) weapon information and processes that are beyond human cognition in "raw" state.



Initial Capability: Use an embedded HPAC server to predict hazardous down wind effects of simulated or occurring NBC weapon attacks or attacks on NBC facilities.

DTRA Making the World Safer


System - WGS 1984: Global Definition II
File View Map Plot Controls Bookmarks Tools TDAs Tracks Corr/Bcst Help
3715N
MARINOULA
MORGAN REINAUER
EARL J CONRAD JR
SANDY POINT
CLIPPER RANGER
TORM AFRICA
LANCASTER
TOKYO EXPRESS
CHESAPEAKE
CINDY J
SEA BULL
CHEYENNE
MARY HOPE
CHALLENGER
ESCORT
*CHEM 171200ZDEC02
DAGMAR MAERSK
MSC MONICA
NEW YORK EXPRES
MAERSK VALENCIA
07615W
07545W
3645N
Properties
OTH REAL WORLD G00101
Attributes Targeting NBCDData Remarks
NBC1
DELTA
dtg 171200ZDEC02
packageName mil.disa.nbcd.data
EFDT
EXER
FOXTROT
location 365500N0760211W
locQualifier AA
packageName mil.disa.nbcd.data
GOLF
HOTEL
MSGID
NBCEVENT
ORGID
packageName mil.disa.nbcd.data
Prev Next OK Cancel Apply
NBC Plume Analysis
363144N 0761218W Number of Objects: -12/149-
172030:10Z DEC 02

WMDD* Host Application Prototype

The WMDD has transitioned to the JEM & JWARN Prog

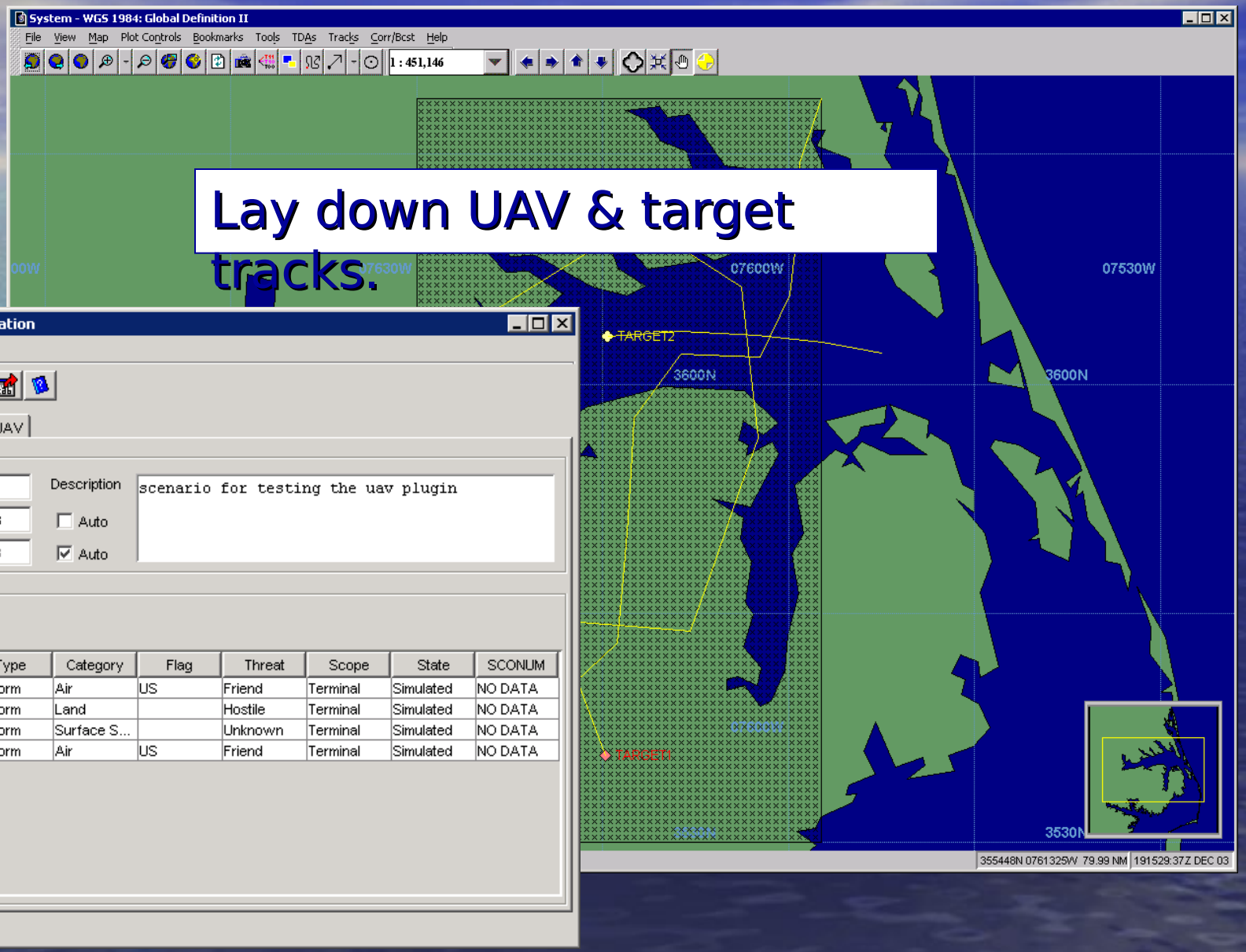
Capabilities

- Estimates down wind contamination, propagation and lethality. (Concentration contours & casualties).
- Layers NBC information into operational picture.
  - Operates with C4I tactical databases.
  - Displays fallout/ contamination clouds & time projections vis-a-vis force movements and populations.
- Interacts with mission planning & operational scenarios.
- Distributes results to other C4I Systems.

* **"Weapons of Mass Destruction Defense – A C4I Host Application"** Paper 03S-SIW-090, Simulation Interoperability Workshop, Spring 2003; Orlando, FL.

Predator Downlink Trainer

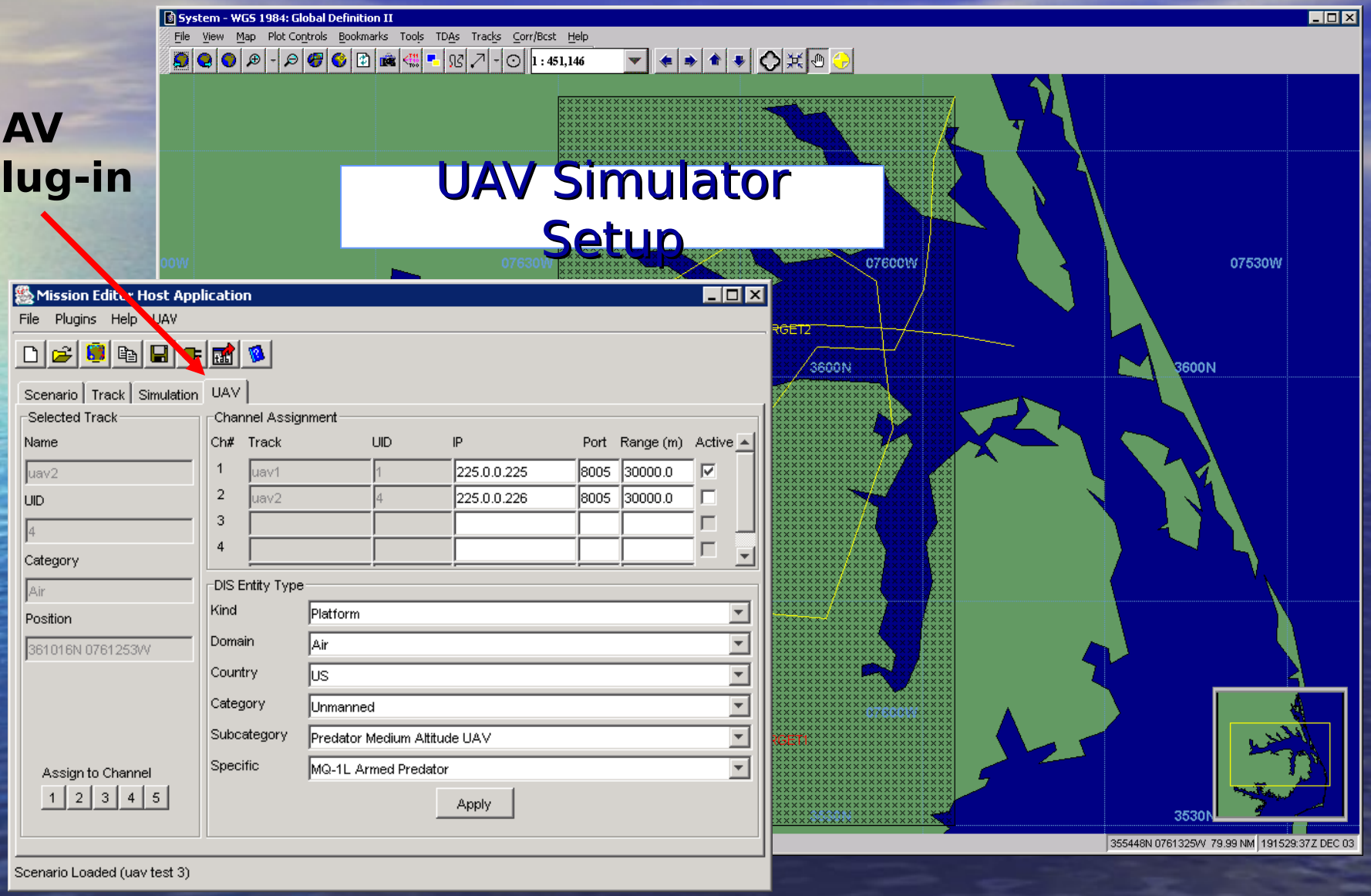
Stimulate the UAV Downlink


System - WGS 1984: Global Definition II
File View Map Plot Controls Bookmarks Tools TDAs Tracks Corr/Bcst Help
1 : 451,146
Lay down UAV & target tracks.
07600W
07530W
3600N
TARGET2
TARGET1
3530N
355448N 0761325W 79.99 NM
191529:37Z DEC 03
Mission Editor Host Application
File Plugins Help UAV
Scenario Track Simulation UAV
Scenario Info
Name
uav test 3
Description
scenario for testing the uav plugin
Start
182222:13Z NOV 03
Auto
End
182352:17Z NOV 03
Auto
Scenario Tracks
Unique ID Name Type Category Flag Threat Scope State SCONUM
1 uav1 Platform Air US Friend Terminal Simulated NO DATA
2 target1 Platform Land Hostile Terminal Simulated NO DATA
3 target2 Platform Surface S... Unknown Terminal Simulated NO DATA
4 uav2 Platform Air US Friend Terminal Simulated NO DATA
Scenario Loaded (uav test 3)

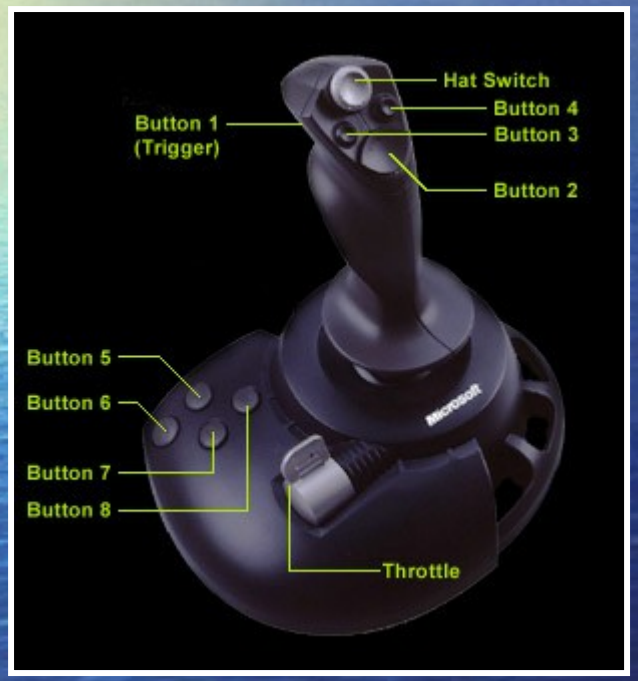
Predator Downlink Trainer

Stimulate the UAV Downlink

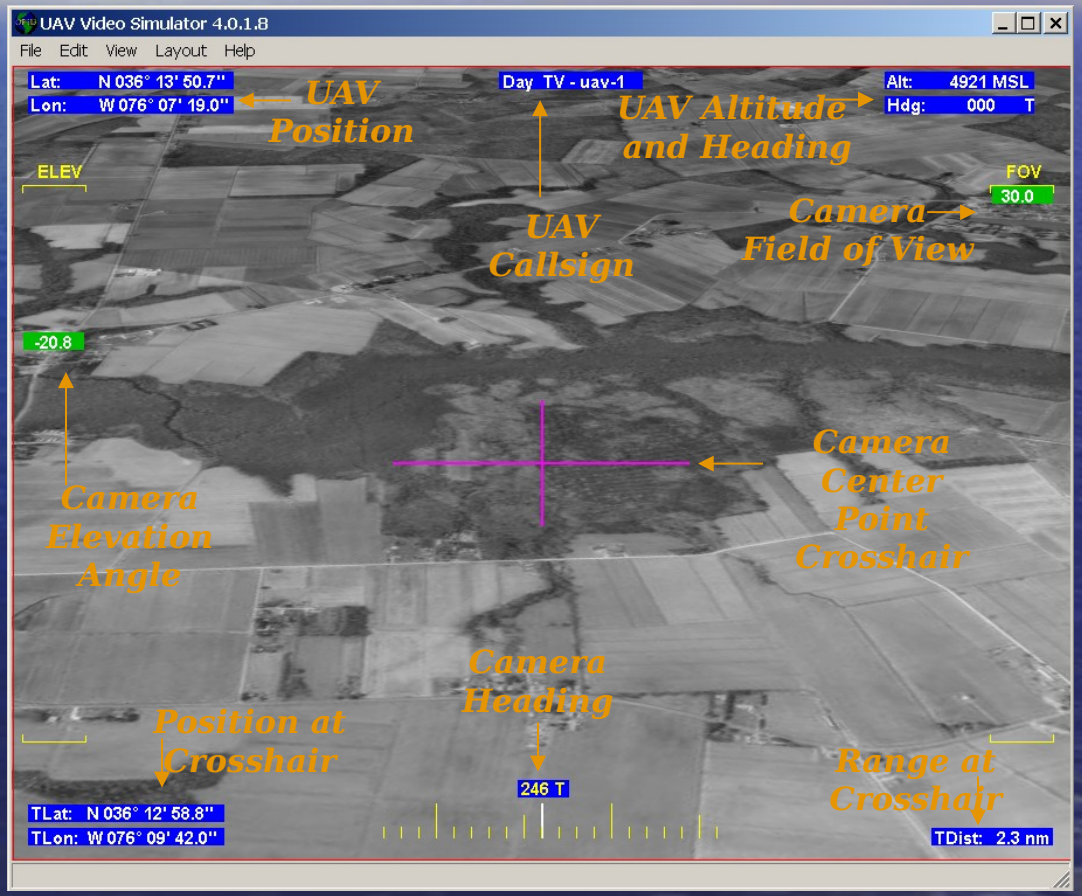
UAV Plug-in



Control the Camera



Simulate the Downlink Video



GCCS/M Predator Downlink Display

Mission Application SDK Advantages

Performance, Reliability & Cost

- Provides > 85% of software needed.
  - **COE/GES:** Network Communication, Map servers, Data Fusion, Sensor Interfaces, Data Base Management, etc.
  - **M&S Services:** Host Application, Mission Editor, COP Capture, Dynamic Run, etc.
- Much easier development environment.
  - Less complex.
  - More reliable.
- Self Integration with all other M&S Applications.
- Embedded Training is included.

SPAWAR

DEPARTMENT OF THE NAVY · NAVAL RESEARCH LABORATORY

navy modeling & simulation management office
NAVMSMO

The C4I Mission Application Software Development Kit will be available to GCCS/M developers in late FY 04.

Mission Application SDK
FY 05 Development Activities

- **Technologies**
  - VTM Server
  - Distributed VTM Synchronization
  - Distributed Applications
  - Multi-Ship Run Time Synchronization
  - External Interfaces (BFTT, Ranges, COLT, etc.)
- **Applications**
  - Training/Exercise Analysis
  - Operations Planning/Rehearsal
  - COA Analysis